

Paleobiogeographic significance of *Trominina hokkaidoensis* (Hayasaka and Uozumi) (Gastropoda: Buccinidae) from the basal part of the Tanami Formation (Oligocene) of the Kii Peninsula, southern Japan

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Abstract. The basal part of the Tanami Formation, in the southern part of the Kii Peninsula, southwest Honshu, southern Japan, contains elements of the Asagai-Poronai fauna (late Eocene to early Oligocene age) of northern Japan. These include *Malletia poronaica* (Yokoyama), *Portlandia* (*Portlandella*) *watasei* (Kanehara), and *Trominina hokkaidoensis* (Hayasaka and Uozumi). The combination of late Eocene to early Oligocene Asagai-Poronai mollusks and previously known Oligocene to early Miocene mollusks from the Tanami Formation implies that the localities discussed here are of Oligocene age. The presence of *Trominina*, which was widespread in the northern Pacific during Paleogene time, suggests that it migrated from northern Japan and northward to southern Japan, in accordance with the Eocene-Oligocene transition global cooling trend.

Key words: migration, mollusks, Paleogene, *Trominina*

Introduction

The Kumano Group crops out in the southern part of the Kii Peninsula in southwest Honshu, Japan (Figure 1A), and has been assigned to the lower to middle Miocene, on the basis of mollusks and foraminifers (Hisatomi, 1981). However, Katto *et al.* (1976) previously studied mollusks of the Kumano Group in the Tanami area of the Kii Peninsula (Figure 1B) and erected the Tanami and Uematsu Formations (Figure 2), which they assigned to the Oligocene and lower Miocene, respectively, on the basis of mollusks.

The basal part of the Tanami Formation yields many species of the Asagai-Poronai fauna that occurs in the upper Eocene to lower Oligocene of Hokkaido and northeast Honshu, northern Japan (Honda, 1994). The Asagai-Poronai mollusks are *Portlandia* (*Portlandella*) *watasei* (Kanehara), *Ampullina asagaiensis* Makiyama, *Beringius hobetsuensis* (Matsui), *Trominina* cf. *T. ishikariensis* (Hayasaka and Matsui), and *Fulgoraria* cf. *F. (Musashia) antiquior* (Takeda) (Katto and Masuda, 1978).

I obtained numerous, but rather poorly preserved molluscan fossils from low cliffs exposed on a wave-cut terrace at Tanosaki, in the basal part of the Tanami Formation (Figure 1B). These are identified as *Malletia*

poronaica (Yokoyama), *Portlandia watasei*, *Acila* (*Acila*) *kiiensis* Masuda and Katto, “*Teredo*” sp., *Turritella* sp., and *Trominina hokkaidoensis* (Hayasaka and Uozumi) (Table 1). *Trominina*, which is one of the earliest evolved buccinid genera, appeared in the region including Sakhalin and Kamchatka during late Eocene time (Titova, 1994). It has been widely recorded from upper Eocene to lower Miocene strata in the North Pacific: Japan, Sakhalin, Kamchatka, the Koryak Upland, Alaska, and Washington (Titova, 1994).

In this paper, I document *T. hokkaidoensis* from the basal part of the Tanami Formation and discuss the paleobiogeographic significance of *Trominina* in Japan, as well as the age of the formation based on mollusks.

Geological setting

The Tanami Formation largely consists of pale grey, fine-grained sandstone, grey siltstone, and alternating beds of sandstone and siltstone, and is approximately 1500 m thick (Katto *et al.*, 1976). Its basal granule conglomerate, some 30 cm thick, is unconformably underlain by black mudstone of the Eocene to Oligocene Shimotsuyu Formation in the upper part of the Muro Group. The Tanami Formation is in fault contact with the overlying

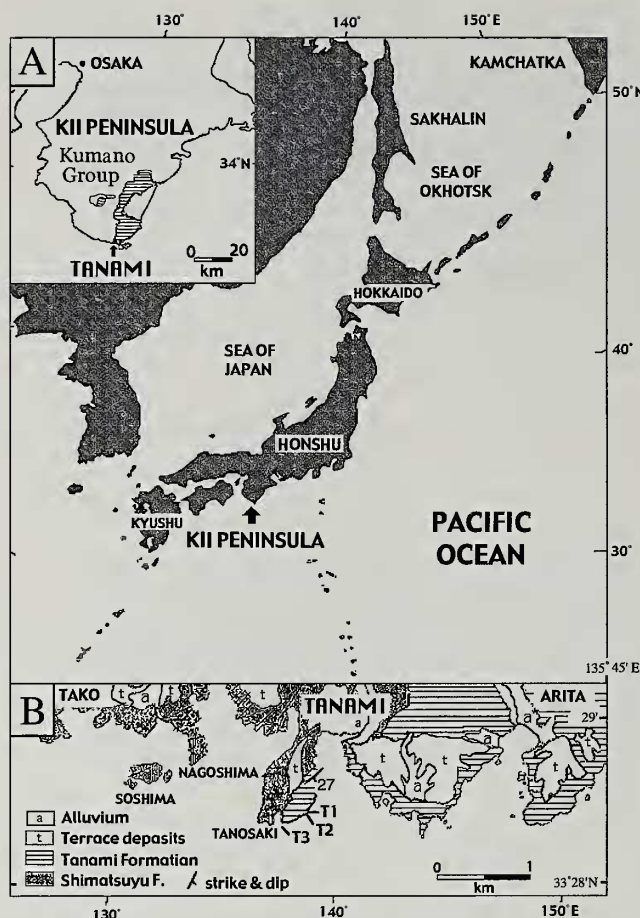


Figure 1. A. Map showing the location of the Kii Peninsula, southwest Honshu, Japan. B. Geologic sketch map of the Tanami area (simplified from Tateishi *et al.*, 1979). T1-T3, fossil localities.

Uematsu Formation (Katto *et al.*, 1976), which contains the Kadonosawa fauna (earliest middle Miocene age; Ogasawara, 2001) (Figure 2).

The upper part of the Muro Group largely contains the Asagai-Poronai fauna, within the Tanami Formation, which includes characteristic elements of this fauna such as *Malletia poronaica*, *Yoldia (Yoldia) laudabilis* Yokoyama, *Y. (Tepidoleda) sobrina* Takeda, *Portlandia watasei*, *P. (Megayoldia) yotsukurensis* Uozumi, *Acila (Acila) elongata* Nagao and Huzioka, *A. (Acila) kusiroensis* Nagao and Huzioka, *Cyclocardia akagii* (Kanehara), *C. tokunagai* (Yokoyama), *Orectospira wadana* (Yokoyama), and *Turritella tokunagai* Yokoyama (Mizuno, 1973).

Discussion

Trominina has been recorded from the Paleogene strata bearing the Asagai-Poronai fauna in Hokkaido, northern Japan. Matsui (1957) recorded *T. japonica* (Takeda) from

AGE Ma	HISATOMI (1981)		KATTO <i>ET AL.</i> (1976)		MOLLUSCAN FAUNA		
	MITSUNO FORMATION		UEMATSU FM.				
15	MIDDLE MIOCENE	KUMANO GROUP	SHIKIYA FORMATION	KUMANO GROUP	KADONOSAWA FAUNA		
16						SHIMOSATO FM.	TANAMI FM.
17							
23 24	EARLY MIO.				AKEYO FAUNA		
30	EOCENE-OLIGOCENE	MURO GROUP	MURO GROUP	MURO GROUP	ASAGAI- PORONAI FAUNA		
36							

Figure 2. Stratigraphic classification of the Muro and Kumano Groups, in association with the molluscan faunal succession.

Table 1. Occurrences of fossil mollusks in the Tanami Formation. A, abundant (10 or more individuals); C, common (5 to 9 individuals); F, few (2 to 4 individuals); R, rare (one individual). One individual is defined herein as consisting of more than half of a separated valve or an articulated pair of bivalves, and more than half of a gastropod specimen.

Species	Locality		
	T1	T2	T3
Bivalvia:			
<i>Malletia poronaica</i> (Yokoyama)			R
<i>Portlandia (Portlandella) watasei</i> (Kanehara)	C	C	C
<i>Acila (Acila) kiiensis</i> Masuda et Katto			R
<i>Acila</i> sp.			R
<i>Caryocorbula?</i> sp.			R
" <i>Teredo</i> " sp.		A	
Gastropoda:			
<i>Turritella</i> sp.		C	
<i>Trominina hokkaidoensis</i> (Hayasaka et Uozumi)	F	R	

the upper Eocene Poronai Formation in the Ishikari coalfield, central Hokkaido. The lower Oligocene Momijiyama Formation in the Ishikari coalfield has yielded several species, including *T. hokkaidoensis*, *T. onnaica* (Yokoyama), *T. ishikariensis* (Hayasaka and Matsui), *T. yubariensis* (Hayasaka and Uozumi), and *T. umbelliformis* (Hayasaka and Uozumi) (Hayasaka and Matsui, 1951; Hayasaka and Uozumi, 1954).

In addition, Honda (1989) recorded *T. japonica*, *T. hokkaidoensis*, *T. ishikariensis*, *T. umbelliformis*, and *T. dispar* (Takeda) from the lower Oligocene Ombetsu Group

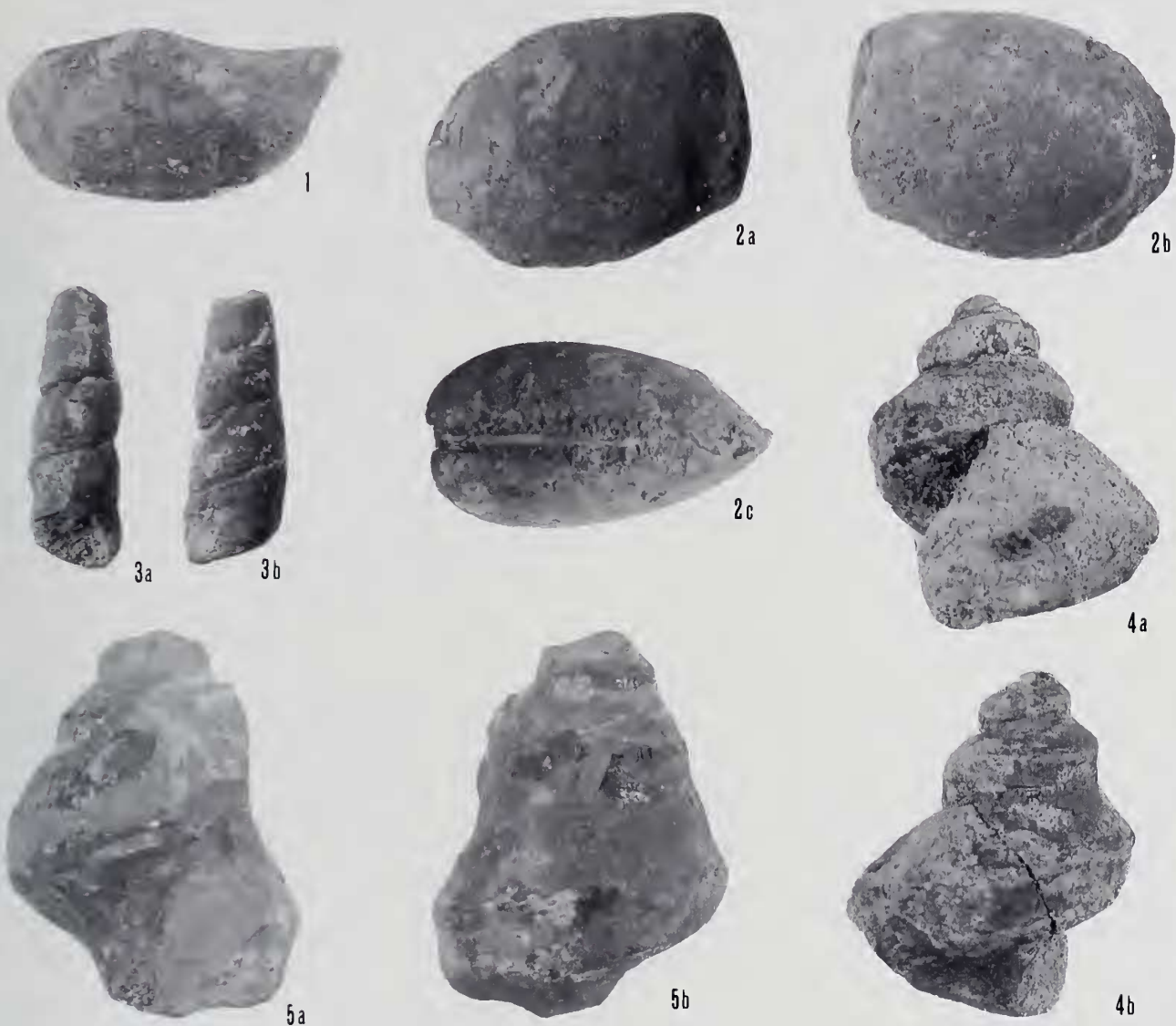


Figure 3. 1. *Portlandia* (*Portlandella*) *watasei* (Kanehara). $\times 1.4$, Loc. T2, MES* 1034. 2a-c. *Acila* (*Acila*) *kiiensis* Masuda and Katto. $\times 1.4$, Loc. T3, MES 1035. 3a, b. *Turritella* sp. $\times 1.6$, Loc. T2, MES 1036. 4, 5. *Trominina hokkaidoensis* (Hayasaka and Uozumi). 4a, b; $\times 1.5$, Loc. T2, MES 1037. 5a, b; $\times 1.5$, Loc. T1, MES 1038. *Abbreviation for the Department of Earth Sciences, Faculty of Education, Mie University.

in the Kushiro coalfield, eastern Hokkaido. The southernmost record of *Trominina* is *T. japonica* from the upper lower Oligocene Yamaga Formation in the Ashiya Group of Kyushu, southern Japan (Tomita and Ishibashi, 1990). This suggests that *Trominina* migrated from Hokkaido and further northward to the Kii Peninsula and Kyushu, southern Japan, in accordance with the Eocene-Oligocene transition global cooling trend. In contrast to these Paleogene records, *T. bicordata* (Hatai and Koike, 1957) from the lower Miocene Hota Group in the Boso Peninsula, central Honshu, is the youngest record of *Trominina* in Japan.

Based on these records of *Trominina*, the presence of

Trominina in the Tanami Formation suggests that the basal part of the Tanami Formation, which also contains the Asagai-Poronai fauna, is of Oligocene rather than Miocene age. Honda *et al.* (1998) recorded the Akeyo fauna (Itoigawa, 1987; early Miocene, ca. 18 to 16 Ma; Figure 2) from the Shimosato Formation of the Ukui area in the southeastern Kii Peninsula. The basal part of the Tanami Formation contains an older fauna than does the partly coeval Shimosato Formation. The Tanami Formation as a whole is assigned to the Oligocene to early Miocene age (Figure 2).

The presence of Asagai-Poronai mollusks in the upper

part of the Muro Group first implied an Oligocene to early Miocene age for these strata (Mizuno, 1973). This is the southernmost record of the Asagai-Poronai fauna; however, it is now known to range from the late Eocene to early Oligocene in Hokkaido and northeast Honshu, northern Japan (Honda, 1994). In addition, Suzuki (1988) assigned the Aikawa Formation, in the upper part of the Muro Group, to the early to earliest middle Eocene age, based on radiolarians. Accordingly, the Shimotsuyu Formation, which is correlative with the Aikawa Formation (Tateishi *et al.*, 1979), is tentatively treated here as an Eocene to Oligocene unit (Figure 2).

Systematic description

Family Buccinidae Rafinesque, 1815

Genus *Trominina* Oyama and Mizuno, 1958

Type species.—*Ancistrolepis japonicus* Takeda, 1953.

Trominina hokkaidoensis (Hayasaka et Uozumi, 1954)

Figure 3.4, 3.5

Ancistrolepis yudaensis Otuka var. *ishikariensis* Hayasaka and Matsui, 1951, p. 334, pl. 1, fig. 3 (*non* fig. 4).

Ancistrolepis hokkaidoensis Hayasaka and Uozumi, 1954, p. 402, pl. 25, fig. 8, pl. 26, fig. 5.

Trominina hokkaidoensis (Hayasaka and Uozumi). Oyama *et al.*, 1960, p. 63, pl. 10, fig. 2 (reproduced from Hayasaka and Uozumi, 1954); Kanno and Ogawa, 1964, p. 291, pl. 4, fig. 3; Honda, 1989, p. 100, pl. 10, fig. 11.

Neptunea dispar Takeda. Katto and Masuda, 1978, pl. 1, fig. 5.

Material examined.—Three specimens (MES coll. cat. nos. 1037, 1038, 1039).

Remarks.—This species is characterized by a high spire ornamented with one relatively weak but acutely expanded keel on the middle part of the whorl. Hayasaka and Matsui (1951, p. 334, pl. 1, figs. 3, 4) erected *Ancistrolepis yudaensis* Otuka var. *ishikariensis* from the Momijiyama Formation (lower Oligocene) of the Ishikari coalfield, central Hokkaido. Hayasaka and Uozumi (1954) later proposed *Ancistrolepis hokkaidoensis* from the Momijiyama Formation, and they doubtfully cited a specimen (Hayasaka and Matsui, 1951, pl. 1, fig. 3) as *A. hokkaidoensis*. *Trominina hokkaidoensis* differs from *T. ishikariensis* in having a weaker keel on the middle part of the whorl.

Gladenkov *et al.* (1988) synonymized *T. onnaica* (Yokoyama), *T. yubariensis*, *T. japonica*, *T. ishikariensis*, *T. hokkaidoensis*, *T. umbelliformis*, and *T. bicordata* with *T. angasiana* (Yokoyama) after studying the Eocene to Oligocene buccinids in Kamchatka. *Trominina yubariensis* and *T. umbelliformis* are characterized by a clearly ex-

panded keel on the middle part of the whorl, as is *T. angasiana*. However, *Trominina onnaica*, *T. japonica*, *T. ishikariensis*, *T. hokkaidoensis*, and *T. bicordata* all bear a relatively weak keel, which differentiates them from *T. angasiana*. Although the taxonomy of the above listed species should be further studied, they are considered here to differ from one another by the surface ornamentation and the outline of whorls.

Trominina hokkaidoensis most closely resembles *T. japonica*, known from the middle Eocene to upper Oligocene 'Maoka' Group in southern Sakhalin, Russia (Takeda, 1953; Kano *et al.*, 2000). However, *T. hokkaidoensis* has a more distinctly expanded body whorl than does *T. japonica*. Katto and Masuda (1978, pl. 1, fig. 5) illustrated *Neptunea dispar* from the Tanami Formation, which is assigned here to *T. hokkaidoensis* based on its more acutely elevated spire.

Associated fauna.—The present species is associated with such sublittoral to bathyal dwellers as *Portlandia watasei* and *Turritella* sp. (Table 1).

Occurrence.—Loc. T1, T2.

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